



PCT
#4

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent application of :
John W. Betteridge :
Serial No.: 10/018,511 : Group Art Unit: NOT KNOWN
Filing Date: December 14, 2001 : Examiner: NOT KNOWN
For: Apparatus and Method for Coating :
the Exterior Surface of a Pipe :

STATUS INQUIRY OF PATENT APPLICATION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

To the Commissioner for Patents:

Applicant makes status inquiry of the above-identified application based upon the following facts.

**CERTIFICATE OF MAILING
UNDER 37 CFR 1.8(a)**

I hereby certify that this paper, along with any paper referred to as being attached or enclosed, is being deposited with the United States Postal Service on the date indicated below, with sufficient postage, as first class mail, in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date: June 2, 2004

Signature

Patricia M. Nicholson

Typed or printed name of
person signing certificate

Applicant filed an entry in U.S. National Phase Application on December 14, 2001. A copy of that application is enclosed. As evidence of filing, applicant submits herewith a copy of the Express Mail Label for the filing and return receipt postcard.

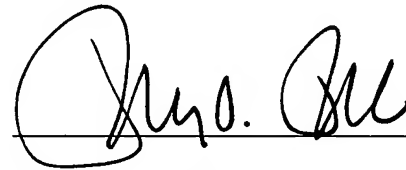
As indicated on the return receipt postcard, the assigned application serial number is 10/018,511.

On January 19, 2004 a revocation of power of attorney and new appointment of power of attorney was mailed for the subject application; a copy of those documents are enclosed.

Neither prior attorney of record nor newly appointed attorney of record has received a USPTO Filing Receipt for the subject application.

Applicant requests status of the subject application and issue of a Filing Receipt for the same.

Respectfully submitted,



02 JUNE 2004

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EL 813789782 US

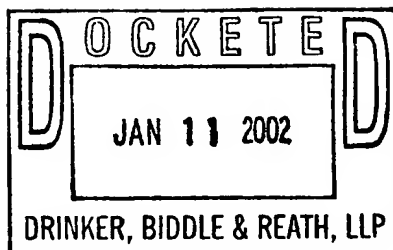


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31770

Attorney Docket No. 946-445

Serial No. PCT/GB01/02189

Re: John W. Betterridge

File Date: December 14, 2001

For: Apparatus And Method For Coating The Exterior Surface Of A Pipe

Commissioner of Patents

United States Patent and Trademark Office

Box PCT

Washington, D.C. 20231

Sir:

Please acknowledge receipt of the attached paper(s) mailed [14 December, 2001] by stamping the date received on this card and returning it to the addressee.

Respectfully submitted,

DRINKER BIDDLE & REATH LLP

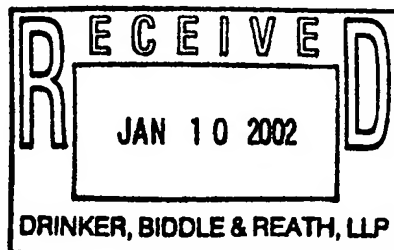
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1. US Entry into National Phase application with executed Declaration (21 pages) 2. 3 sheets of drawings 3. Transmittal Letter (2 pages) 4. Preliminary Admendment (9 pages) 5. A check in the amount of \$1,082.00.

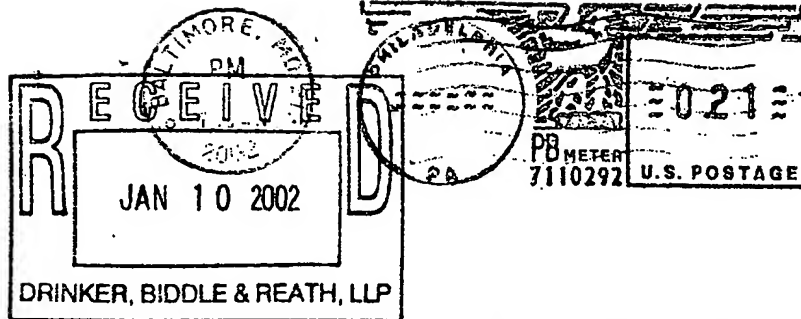
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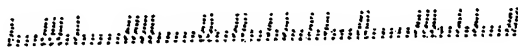
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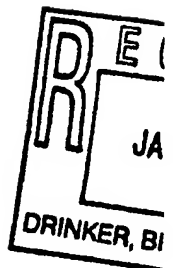


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DRINKER BIDDLE & REATH LLP
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Philadelphia, PA 19103-6996

9103+6996 



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PATENT APPLICATION
DOCKET NO. 946-445 US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Patent application of
John W. Betteridge

Serial No. 10/018,511

Filed: December 14, 2001

For: Apparatus and Method for Coating the Exterior Surface of a Pipe

:
: Examiner:
: NOT YET ASSIGNED
:
: Group Art Unit: ~~4733~~
: NOT YET ASSIGNED
:

REVOCATION OF POWER OF ATTORNEY and
NEW APPOINTMENT OF POWER OF ATTORNEY

Box – NON-FEE AMENDMENT
Commissioner for Patents
Washington, D.C. 20231

To the Commissioner for Patents:

Applicant files herewith a revocation of power of attorney and a new appointment of power of authority for the above identified application.

Respectfully submitted,

**CERTIFICATE OF MAILING
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Date: JAN. 19, 2004

Patricia M. Nicholson
Signature,

PATRICIA M. NICHOLSON

Typed or printed name of
person signing certificate

JOHN W. BETTERIDGE

By:

Philip O. Post
PHILIP O. POST

USPTO Atty. Registration No. 28,456
Inductotherm Industries, Inc.
Post Office Box 157
Rancocas, New Jersey 08073
Telephone: (609) 267-9000, ext 254
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PTO/SB/81 (02-01)

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POWER OF ATTORNEY OR AUTHORIZATION OF AGENT

Application Number	10/018,511
Filing Date	12/14/2001
First Named Inventor	John W. Betteridge
Title	Apparatus and Method for Coating The Exterior of a Pipe
Group Art Unit	
Examiner Name	
Attorney Docket Number	946-445 US

I hereby appoint:

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Philip O. Post	28,456

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☒ Applicant/Inventor.

☐ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).

SIGNATURE of Applicant or Assignee of Record

Name	John W. Betteridge APPLICANT
Signature	<i>John W. Betteridge</i>
Date	10.10.03.

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

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REVOCATION OF POWER OF ATTORNEY OR AUTHORIZATION OF AGENT	Application Number	10/018,511
	Filing Date	12/14/2001
	First Named Inventor	John W. Betteridge
	Group Art Unit	
	Examiner Name	
	Attorney Docket Number	946-445 US

I hereby revoke all previous powers of attorney or authorizations of agent given in the above-identified application:

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☒ Applicant/Inventor.

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Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)

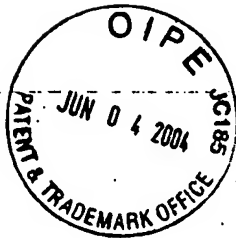
SIGNATURE of Applicant or Assignee of Record

Name	John W. Betteridge APPLICANT
Signature	<i>John W. Betteridge</i>
Date	16.10.03

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

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946-445 US Revocation / Appointment POA

Inventor(s): Betteridge

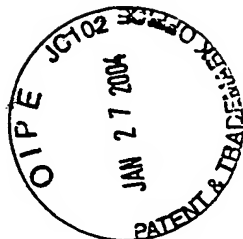
Title: APPARATUS AND METHOD FOR COATING THE EXTERIOR OF A PIPE
via: first class mail certificate

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2. Revocation of Power of Attorney
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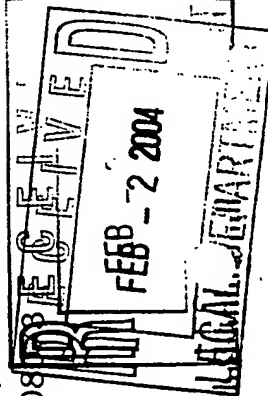
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CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10)

Applicant(s): John W. Betteridge

Docket No.

946-445

Serial No.

PCT/GB01/02189

Filing Date

Int'l 05/17/01

Examiner

Group Art Unit

Invention: APPARATUS AND METHOD FOR COATING THE EXTERIOR SURFACE OF A PIPE

I hereby certify that the following correspondence:

Entry in U.S. National Phase Application, associated papers and filing fees

(Identify type of correspondence)

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December 14, 2001

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Therese McKinley

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Therese McKinley

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EL 813789782 US

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PATENT

Attorney Docket No.: 946-445

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
US/PCT/DOE ACTING AS RECEIVING OFFICE

In re: Patent application of :
John W. Betteridge :
Serial No.: Not Yet Assigned : Group Art Unit:
(International Serial No. PCT/GB01/02189) : Not Yet Assigned
Filed: Concurrently Herewith : Examiner:
(International Filing Date: May 17, 2001) :
For: Apparatus And Method For Coating The : Not Yet Assigned
Exterior Surface Of A Pipe :

PRELIMINARY AMENDMENT

Commissioner for Patents
Box PCT
Washington, D.C. 20231

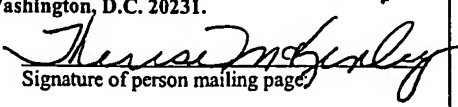
Dear Sir:

Prior to calculation of the filing fee, kindly amend the above-identified patent application, without prejudice, as follows.

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EXPRESS MAIL Mailing Label Number: EL 813789782 US
Date of Deposit: December 14, 2001

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Signature of person mailing page

Therese McKinley
Type or print name of person

In the Claims:

Please amend **claims 6-11, 14-15, 18-22 and 25-26** as follows. A mark-up of the amended claim as required by 37 C.F.R. 1.211(c)(ii) is attached hereto as Appendix A.

6. The apparatus of claim 1 wherein the at least one coating head has a diffusing means with the internal passage of the at least one coating head.

7. The apparatus of claim 1 further comprising means for supplying a grit from an external source to the at least one internal gallery and means for applying positive air pressure to the at least one internal gallery, whereby the grit is forced by air pressure through the at least one internal gallery and ejected onto the exterior surface of the pipe through the at least one coating head.

8. The apparatus of claim 1 further comprising means for supplying a gas from an external source to the at least one internal gallery and means for applying positive air pressure to the at least one internal gallery, whereby the heated gas is forced by air pressure through the at least one internal gallery and ejected onto the exterior surface of the pipe through the at least one coating head.

9. The apparatus of claim 1 further comprising means for supplying a quench fluid from an external source to the at least one internal gallery and means for applying positive air pressure to the at least one internal gallery, whereby the quench fluid is forced by air pressure through the at least one internal gallery and ejected onto the exterior surface of the pipe through the at least one coating head.

10. The apparatus of claim 1 wherein the stator and the rotor include means for opening and closing around the pipe.

11. The apparatus of claim 1 further comprising at least one magnetic induction heater to heat the pipe prior to placement of the coating material onto the exterior surface of the pipe.

14. The method of claim 12 further comprising the following steps:
supplying at a positive air pressure a gas to the stationary element;
transferring the gas from the stationary element to the gallery; and
ejecting the gas onto the exterior surface of the pipe from one or more coating heads.
15. The method of claim 12 further comprising the following steps:
supplying at a positive air pressure a quench liquid to the stationary element;
transferring the quench liquid from the stationary element to the gallery;
and
ejecting the quench liquid onto the exterior surface of the pipe from one or more coating heads.
18. The apparatus of claim 16 wherein the annular-shaped body includes means for opening and closing around the pipe.
19. The apparatus of claim 16 further comprising means for supplying a grit from an external source to the at least one entry ports and means for applying positive air pressure to the at least one entry ports, whereby the grit is forced under air pressure successively through the intake, compression and diffusing chambers, into the gallery and ejected through the one or more openings in the interchangeable sleeve onto the exterior surface of the pipe around the entire circumference of the pipe.
20. The apparatus of claim 16 further comprising means for supplying a gas from an external source to the at least one entry ports and means for applying positive air pressure to the at least one entry ports, whereby the gas is forced under air pressure successively through the intake, compression and diffusing chambers, into the gallery and ejected through the one or more openings in the interchangeable sleeve onto the exterior surface of the pipe around the entire circumference of the pipe.

21. The apparatus of claim 16 further comprising means for supplying a quench liquid from an external source to the at least one entry ports and means for applying positive air pressure to the at least one entry ports, whereby the quench liquid is forced under air pressure successively through the intake, compression and diffusing chambers, into the gallery and ejected through the one or more openings in the interchangeable sleeve onto the exterior surface of the pipe around the entire circumference of the pipe.

22. The apparatus of claim 16 further comprising at least one magnetic induction heater to heat the pipe prior to placement of the coating material on to the exterior surface of the pipe.

25. The method of claim 23 further comprising the following steps:

supplying at a positive air pressure a gas to the at least one intake chamber;

compressing the gas received from the at least one intake chamber in the compression chamber;

diffusing the gas exiting the compression chamber in the at least one diffusing chamber;

injecting the gas exiting the compression chamber into the gallery; and

ejecting the gas from the compression chamber onto the exterior surface of the pipe.

26. The method of claim 23 further comprising the following steps:

supplying at a positive air pressure a quench liquid to the at least one intake chamber;

compressing the quench liquid received from the at least one intake chamber in the compression chamber;

diffusing the quench liquid exiting the compression chamber in the at least one diffusing chamber;

injecting the quench liquid exiting the compression chamber into the gallery; and

ejecting the quench liquid from the compression chamber onto the exterior surface of the pipe.

REMARKS

Claims 1-26 are pending in the application. The claims have been amended to reduce dependencies. No new matter has been introduced.

An early action on the merits is solicited.

Respectfully submitted,

JOHN W. BETTERRIDGE

BY: 

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One Logan Square
18th and Cherry Streets
Philadelphia, PA 19103-6996
(215) 988-3309
(215) 988-2757 – Fax
Attorney for the Applicant

6. The apparatus of [any preceding claim] claim 1 wherein the at least one coating head has a diffusing means with the internal passage of the at least one coating head.

7. The apparatus [any preceding claim] of claim 1 further comprising means for supplying a grit from an external source to the at least one internal gallery and means for applying positive air pressure to the at least one internal gallery, whereby the grit is forced by air pressure through the at least one internal gallery and ejected onto the exterior surface of the pipe through the at least one coating head.

8. The apparatus of [any preceding claim] claim 1 further comprising means for supplying a gas from an external source to the at least one internal gallery and means for applying positive air pressure to the at least one internal gallery, whereby the heated gas is forced by air pressure through the at least one internal gallery and ejected onto the exterior surface of the pipe through the at least one coating head.

9. The apparatus of [any preceding claim] claim 1 further comprising means for supplying a quench fluid from an external source to the at least one internal gallery and means for applying positive air pressure to the at least one internal gallery, whereby the quench fluid is forced by air pressure through the at least one internal gallery and ejected onto the exterior surface of the pipe through the at least one coating head.

10. The apparatus of [any preceding claim] claim 1 wherein the stator and the rotor include means for opening and closing around the pipe.

11. The apparatus of [any preceding claim] claim 1 further comprising at least one magnetic induction heater to heat the pipe prior to placement of the coating material onto the exterior surface of the pipe.

14. The method of [claims 12 or 13] claim 12 further comprising the following steps:

supplying at a positive air pressure a gas to the stationary element;

transferring the gas from the stationary element to the gallery;

and ejecting the gas onto the exterior surface of the pipe from one or more coating heads.

15. The method of [any one of claims 12 to 14] claim 12 further comprising the following steps:

supplying at a positive air pressure a quench liquid to the stationary element;

transferring the quench liquid from the stationary element to the gallery;
and

ejecting the quench liquid onto the exterior surface of the pipe from one or more coating heads.

18. The apparatus of [anyone of claims 16 or 17] claim 16 wherein the annular-shaped body includes means for opening and closing around the pipe.

19. The apparatus of [any one of claims 16 or 18] claim 16 further comprising means for supplying a grit from an external source to the at least one entry ports and means for applying positive air pressure to the at least one entry ports, whereby the grit is forced under air pressure successively through the intake, compression and diffusing chambers, into the gallery and ejected through the one or more openings in the interchangeable sleeve onto the exterior surface of the pipe around the entire circumference of the pipe.

20. The apparatus of [any one of claims 16 to 19] claim 16 further comprising means for supplying a gas from an external source to the at least one entry ports and means for applying positive air pressure to the at least one entry ports, whereby the gas is forced under air pressure successively through the intake, compression and diffusing chambers, into the gallery

and ejected through the one or more openings in the interchangeable sleeve onto the exterior surface of the pipe around the entire circumference of the pipe.

21. The apparatus of [anyone of claims 16 to 20] claim 16 further comprising means for supplying a quench liquid from an external source to the at least one entry ports and means for applying positive air pressure to the at least one entry ports, whereby the quench liquid is forced under air pressure successively through the intake, compression and diffusing chambers, into the gallery and ejected through the one or more openings in the interchangeable sleeve onto the exterior surface of the pipe around the entire circumference of the pipe.

22. The apparatus of [any one of claims 16 to 21] claim 16 further comprising at least one magnetic induction heater to heat the pipe prior to placement of the coating material on to the exterior surface of the pipe.

25. The method of [claims 23 or 24] claim 23 further comprising the following steps:

supplying at a positive air pressure a gas to the at least one intake chamber;

compressing the gas received from the at least one intake chamber in the compression chamber;

diffusing the gas exiting the compression chamber in the at least one diffusing chamber;

injecting the gas exiting the compression chamber into the gallery; and

ejecting the gas from the compression chamber onto the exterior surface of the pipe.

26. The method of [any one of claims 23 to 25] claim 23 further comprising the following steps:

supplying at a positive air pressure a quench liquid to the at least one intake chamber;

compressing the quench liquid received from the at least one intake chamber in the compression chamber;

diffusing the quench liquid exiting the compression chamber in the at least one diffusing chamber;

injecting the quench liquid exiting the compression chamber into the gallery; and

ejecting the quench liquid from the compression chamber onto the exterior surface of the pipe.

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

INTERNATIONAL APPLICATION NO.
PCT/GB01/02189INTERNATIONAL FILING DATE
May 17, 2001PRIORITY DATE CLAIMED
May 20, 2000

TITLE OF INVENTION

APPARATUS AND METHOD FOR COATING THE EXTERIOR SURFACE OF A PIPE

APPLICANT(S) FOR DO/EO/US
JOHN W. BETTERIDGE

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☒ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☐ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☒ Certificate of Mailing by Express Mail
23. ☐ Other items or information:

24. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO | \$1040.00 |
| <input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO | \$890.00 |
| <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO | \$740.00 |
| <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) | \$710.00 |
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\$890.00	
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Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	26 - 20 =	6	x \$18.00	\$108.00	
Independent claims	4 - 3 =	1	x \$84.00	\$84.00	
				\$0.00	

Multiple Dependent Claims (check if applicable) ☐

TOTAL OF ABOVE CALCULATIONS =

\$1,082.00

☐ Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.

\$0.00

SUBTOTAL =

\$1,082.00

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).

\$0.00

TOTAL NATIONAL FEE =

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Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). ☐

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- d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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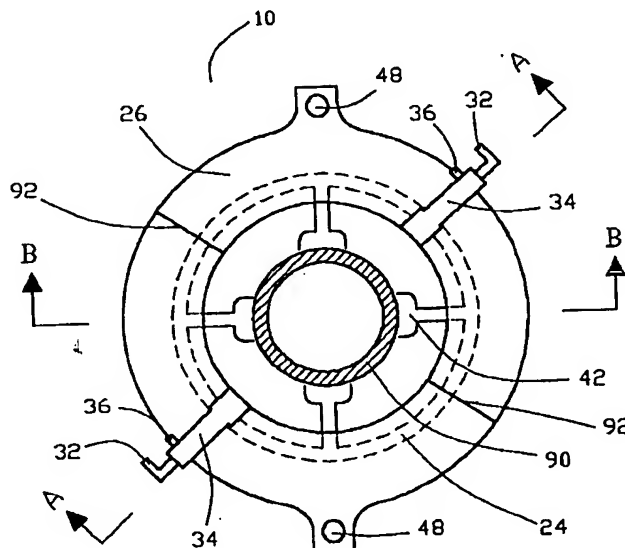
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(54) Title: APPARATUS AND METHOD FOR COATING THE EXTERIOR SURFACE OF A PIPE



(57) Abstract: The exterior surface of a pipe is coated around its full perimeter without rotation of the pipe or the complete coating apparatus. In one example, the coating apparatus includes coating heads attached to a rotor with the coating material supplied under positive air pressure via a stator. The coating heads rotate with the rotor and eject coating material onto the exterior surface of the pipe. In a second example, the coating apparatus is stationary and coating material is delivered under positive air pressure through chambers within the apparatus.

WO 01/89710 A2



APPARATUS AND METHOD FOR COATING THE EXTERIOR SURFACE OF A PIPE

BACKGROUND OF THE INVENTION

- 5 1. Field of the Invention: The present invention relates to the application of a coating material to the outer surface of a pipe wherein neither the pipe nor the entire coating apparatus need be rotated to accomplish a coating around a complete circumferential area of the pipe.
- 10 2. Description of Related Art: Pipelines laid overland or under water are assembled from generally cylindrical sections of hollow pipe that are suitably joined together. A typical section that is used to fabricate an oil or gas pipeline has a length of approximately 20 metres and an outside diameter ranging from approximately 1 to 20 metres. A suitable joining process, such as welding, is used to join the pipe sections together. Each
- 15 section of pipe is manufactured with an exterior coating that typically consists of an inner protective coating layer and an outer insulative layer. The protective layer, with a typical thickness of 1 mm, is formed by rotating the section of pipe whilst the material is applied to the pipe. A suitable composition is a fusion-bonded thermoplastic powder with an epoxy,
- 20 polypropylene or polyethylene base that is applied to a pre-heated rotating section of pipe. The insulative layer, with a thickness generally on the order of 50 to 60 mm, is typically applied by an extrusion process. In order to join sections together, the insulative and protective coating layers must be cut or stripped back from each end of a section to expose the pipe material for the
- 25 joining process. After the joining is completed, the exterior coating must be restored in the field to ensure integral coating of the pipeline. When a thermoplastic material is used, the coating material, in powdered form, is applied to the exterior of a pipe that has been preheated to achieve fusion of the material when it comes in contact with the pipe. For ferrous pipes,
- 30 heating is generally accomplished by magnetic induction. Prior art

processes and apparatus for accomplishing this task are disclosed in U.S. Patent No. 4,595,607. An adhesive material, which can be a polypropylene-based composition, is normally applied over the protective coating by a similar process. Finally, the thicker insulative material is laid over the adhesive by an extrusion process.

Exterior protective coating of an entire pipe may be accomplished by an electrostatic process in which a pipe that has an induced charge on its surface is rotated over a coating material having an opposing charge.

A disadvantage of the prior art is that either the entire coating apparatus or the pipe must be rotated to achieve a full 360-degree coating of an area around the outer perimeter of the pipe.

Therefore, there exists the need for apparatus and method that can apply a 360-degree perimetrical band of coating material to the exterior surface of a pipe without rotating either the pipe or the coating apparatus.

An object of the present invention is to provide apparatus and method for applying a coating material around the complete perimeter of the exterior of a pipe without rotating the pipe or all components of the coating device. An outer stationary or stator element remains static whilst an inner rotor element is used to achieve a 360-degree perimetrical coating.

Another object of the present invention is to provide apparatus and method for applying a coating material around the complete perimeter of the exterior of a pipe without rotating the pipe or the coating device. The entire coating device remains stationary whilst a 360-degree perimetrical coating of the pipe is achieved.

25

BRIEF SUMMARY OF THE INVENTION

In its broad aspects, the present invention is an apparatus and method for application of coating material to the exterior surface of a pipe. The apparatus surrounds the exterior surface of the pipe and comprises a

stationary component or stator, and a rotating component, or rotor. The rotor is located within the stator and is free to rotate around the pipe relative to the fixed stator. The rotor comprises at least one internal gallery or enclosed passage that extends substantially around the rotor. One or
5 more coating heads are attached to the rotor. Each coating head has an internal passage that is connected to the gallery and an opening for ejecting the coating material onto the exterior surface of the pipe. The coating material is supplied from an external source to the gallery. Positive air pressure is maintained within the gallery to force the coating material out of
10 the opening in the coating head.

In another aspect, the present invention is an apparatus and method wherein the pipe and entire coating apparatus remains stationary whilst a complete circumferential area on the exterior of the pipe is coated. Coating material is supplied at a positive air pressure into a compression
15 chamber within a substantially annular body of the coating apparatus. The compression chamber is substantially continuous around an inner radius of the body. Air pressure forces the coating material through the compression chamber and into one or more diffusing chambers, which are also within the body of the coating apparatus and are substantially continuous around
20 an inner radius of the body. Coating material exits the diffusing chambers into a gallery on the inner side of the annular body. An interchangeable centre section is positioned against the gallery. The centre section has one or more openings in it to eject coating material from the galley and onto the exterior surface of the pipe.

25 These and other aspects of the invention will be apparent from the following description.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. 1 is a front elevational view of one example of a coating apparatus of the present invention.

FIG. 2 is a cross-sectional view of a coating apparatus with sectioning plane defined by line A—A in **FIG. 1**

FIG. 3 is a cross-sectional view of a coating apparatus with sectioning plane defined by line B—B in **FIG. 1**

FIG. 4 is a side partial cross-sectional detail of one example of a means for driving the rotor of the coating apparatus shown in **FIG. 1**.

FIG. 5 is a cross-sectional view of one example of a coating head used with the coating apparatus shown in **FIG. 1**.

FIG. 6 is a front elevational view of another example of the coating apparatus of the present invention.

FIG. 7 is a cross-sectional view of the coating apparatus with sectioning plane defined by line C—C in **FIG. 6**.

DETAILED DESCRIPTION OF THE INVENTION

There is shown in **FIG. 1** through **FIG. 5** a first example of coating apparatus 10 of the present invention. Substantially annular rotor elements 20 and 22 are suitably joined together to form a rotor. Enclosed within the rotor is a gallery 24 (hidden and shown by dashed lines in **FIG. 1**) that extends substantially around the rotor. The rotor has a central axis that is common with the central axis of pipe 90 (shown in cross-section in **FIG. 1**). Stator elements 26 and 28 are disposed around the rotor and suitably joined together to form a stator. Means for providing free rotation

of the rotor relative to the stator such as the ball bearings **30** shown in **FIG. 2** are provided. Whilst the stator and rotor for the example in **FIG. 1** are formed from two elements, they may be fabricated in different fashion to suit other materials and methods of assembly without deviating from the scope of the invention. Furthermore, whilst the stator in **FIG. 1** is shown as a substantially annular structure, in other examples, the stator may be of another shape, such as rectangular. The stator and rotor may be machined from hard anodized aluminum and coated with a friction reducing material such as TEFLON to provide a favorable boundary surface in the internal passages as further described below.

As stated above, a suitable, but not limiting, coating material is a fusion-bonded epoxy in powdered form. The coating material is provided from an external source via a suitable pipe or tubing (not shown in the drawings) that is connected to material port **32** of vacuum displacement pump **34**. Air port **36** on the pump is connected to a regulated compressed air supply (typically from 30 to 30 psi for this example) by suitable pipe or tubing (not shown in the drawings). Regulating the supply of air to a venturi in pump **34** controls the intake draw of coating material into the coating apparatus and provides the means for keeping the coating material within the apparatus under positive air pressure. The term "fluidized" powder can be used to describe the coating material as it mixes with the injected air and reduces in density to a state suitable for passage within the coating apparatus of the present invention. A particular advantage of the present invention is that the non-rotating rotor provides a stationary structure for mounting each vacuum displacement pump. Therefore, the coating material and compressed air connections to each pump are not complicated by connecting to a rotating element.

Whilst the coating apparatus **10** shown in **FIG. 1** uses two vacuum displacement pumps disposed on one of the two stator elements,

other examples of the invention can have a different number of pumps that are attached to one stator face, or distributed between both stator faces.

Pump outlet **38** injects the fluidized powder into gallery **24**.

5 Seals **40** serve as means to keep the powder within the gallery as the rotor rotates relative to the stator and pump outlet **38**. The seals are designed to withstand the positive air pressure exerted on the powder within the gallery. As shown in **FIG. 3**, pressurized air may optionally be blown into one or more ports **33** on the rotor to assist in maintaining a positive air pressure on the seals **40**.

10 Coating material is ejected from the gallery **24** through one or more coating heads **42** that are attached to the rotor and have an internal passage connected to the gallery. When the coating material is a thermoplastic material, pipe **90** will be preheated prior to the application of coating material to fuse the material onto the exterior surface of the pipe.

15 Optionally the exterior surface of pipe **90** can be grit blasted prior to coating by providing a suitable grit from an external source via a suitable pipe or tubing that is connected to material port **32** of one or more of the vacuum pumps **34**. Alternatively one or more dedicated grit vacuum pumps can be provided around one or both of the stator faces.

20 As shown in **FIG. 5**, a coating head **42** can be provided with one or more interior diffusers **46** in the form of a disc or other shape to control the flow of coating material through the head and onto the exterior surface of the pipe. The coating head, including opening **44**, can be configured as best to suit coating material ejection for a particular application. In the present example, diffuser **46** deflects the fluidized powder to the side wall
25 **45** of the coating head so that the powder exits opening **44** in a generally uniform flow profile across the entire width of the opening. Preferably each coating head is removably attached to the rotor so that it can be removed

and exchanged with a head of differing length, or fitted with a length extension fitting so that differing diameters of pipe can be accommodated.

Suitable drive means are provided to rotate the rotor. One method of driving the rotor is shown in **FIG. 4**. Motor **48** is connected to sprocket **50** via output shaft **52**. A chain (not shown in the drawings) engages sprocket **50** and radially projected teeth (not shown in the drawings) on the circular side surface of the rotor to deliver rotational power from the drive motor to the rotor. Whilst two motors are used in this example, a differing number and configuration may be used to suit a specific application.

In applications where the coating apparatus is slipped onto a section of pipe or slid along pipe sections as a pipeline is assembled, the stator and rotor can be formed as continuous elements around their circumferences. In other examples of the apparatus, the stator and rotor can include means for opening and closing around a section of pipe, such as two split or hinged members with interface boundaries **92** shown in **FIG. 1**.

Either the pipe or the coating device may be moved in its axial direction to effect coating along the length of the pipe. When the coating material is a thermoplastic material, pipe **90** will be preheated prior to the application of coating material to fuse the material onto the exterior surface of the pipe.

Optionally when application of a gas prior and during coating is desirable, the gas may be supplied to one or more of air ports **36** or one or more dedicated gas ports provided around one or both of the stator faces to inject the gas into gallery **24** prior and during coating. This is of particular value when polypropylene is the coating material and the gas is heated air that is applied prior and during coating.

Subsequent to coating, a quench fluid, either in liquid or gaseous form, can be supplied from an external source via a suitable pipe or

tubing that is connected to material port **32** of one or more of the vacuum pumps **34**. Alternatively one or more dedicated quench fluid pumps can be provided around one or both of the stator faces.

5 In applications where a combination of grit blasting and/or quenching are used, suitable valve arrangements can be provided upstream of the input to material port **32** to facilitate selection of the substance that is fed to the port.

10 There is shown in **FIG. 6** and **FIG. 7** a second example of the coating apparatus **10** of the present invention. The apparatus comprises a substantially annular body **60**, which has a plurality of entry ports **62** protruding from it. The number of entry ports for a particular application is governed by the diameter of the pipe **90** (shown in cross-section in **FIG. 6** and **FIG. 7**) that is being coated and are, in general, symmetrically arranged around its outer perimeter. The annular body **60** can be formed from two
15 machined halves. Hard anodized aluminum is a suitable material. A coating of a friction reducing material such as TEFLON is preferable to provide a favorable boundary surface in the entry ports and other internal passages as further described below.

A mixing chamber **64** is connected to each of the entry ports.
20 The mixing chamber is used as a means to introduce the coating material into the entry port at a positive air pressure. For this particular example, the coating material is introduced into the mixing chamber from fitting **66**. Fitting **66** is attached to chamber **64** and has a material port **68** for connection to an external source of coating material via suitable pipe or
25 tube (not shown in the drawings). Air port **70** in fitting **66** is connected to a regulated compressed air supply (generally with a range from 30 to 40 psi for the present example) by suitable pipe or tubing (not shown in the drawings). Regulating the supply of air to a venturi in fitting **66** controls the intake draw of coating material into the coating apparatus and provides the

means for keeping the coating material (fluidized powder) within the apparatus under positive air pressure. Mixing chamber **64** has an air port **72** attached to it by which generally low pressure (in the range of 4 to 5 psi) and high volume (in the range of 20 to 25 cfm) air from a suitable source
5 such as a low pressure air compressor (not shown in the figures) is supplied. The low-pressure air serves to force the coating material entering the mixing chamber from fitting **66** into entry port **62** and to further reduce the density of powder if required for a particular application.

Intake chamber **74** (hidden and shown as dashed lines in **FIG. 6**) within body **60** transfers the coating material from an entry port to
10 compression chamber **76** that runs substantially around an inner diameter of body **60** (hidden and shown as dashed lines in **FIG. 6**). In this example, the intake chamber has a generally circular cross-section, and the compression chamber has a combination oval and funnel-shaped
15 cross-section. Other shapes are suitable for the compression chamber as long as the chamber serves to compress the coating material under positive air pressure. The coating material is forced by air pressure down through compression chamber **76** and into diffusing chamber **78**. In this example, the diffusing chamber is a substantially oval passage that opens into the
20 sides of gallery **80**. Interchangeable centre section **82** is a collar that is seated within the inner radial surface of annular body **60** to accommodate the outer diameter of the pipe **90** to be coated. One or more appropriate openings **84** are provided through the thickness of the centre section **82** to permit ejection of coating material onto the outer diameter of pipe **90**. In
25 the present example, opening **84** is a substantially continuous circumferential opening in the centre section to permit ejection of coating material 360 degrees around the perimeter of the pipe **90**. In this manner, neither the pipe **90** nor coating device **10** need to be rotated to achieve a complete coating around the perimeter of the pipe. In alternative examples,

satisfactory rotating means maybe provided with the coating device to rotate it if required for a particular coating process. Either the pipe or coating device may be moved in its axial direction to effect coating along the length of the pipe. When the coating material is a thermoplastic material, pipe 90 will be preheated prior to the application of coating material to fuse the material onto the exterior surface of the pipe.

The configuration of the coating apparatus 10 shown in FIG. 6 and FIG. 7, namely with four entry ports 62 arranged substantially 45 degrees apart from each other, can preferably (but not in limitation) be used to deposit a complete 360-degrees band of coating material around the exterior perimeter of a pipe having an outside diameter ranging from approximately 5 to 13 cm. For pipes of larger diameter, a greater number of entry ports can be used without deviating from the scope of the invention.

In applications where the coating apparatus shown in FIG. 6 and FIG. 7 is slipped onto a section of pipe or slid along pipe sections as a pipeline is assembled, body 60 can be formed as a continuous element around their circumferences. In other examples of the apparatus, the body can include means for opening and closing around a section of pipe, such as two split or hinged members with interface boundaries 94 shown in FIG. 6.

Options similar to those disclosed for the first example of the invention can be used for the second example of the invention shown in FIG. 6 and FIG. 7. Suitable grit can be provided to material port 68 of one or more of the fittings 66. Alternatively one or more dedicated grit material and entry ports can be provided around the perimeter of annular body 60 for injecting grit into compression chamber 76. A gas can be supplied to one or more air ports 70 prior and during coating. Alternatively one or more dedicated gas ports can be provided to inject the gas into the intake and compression chamber. A quench fluid can be provided to material port 68 of one or more of the fittings 66. Alternatively one or more dedicated

quench fluid fittings can be provided around the perimeter of annular body
60.

In other examples of the invention, a magnetic induction
heating assembly may be combined with the coating apparatus of the
5 present invention to form a single stationary apparatus for preheating and
coating around a complete circumferential area of the pipe.

CLAIMS

1. An apparatus for application of a coating material to the exterior surface of a pipe comprising:

a stator disposed around the exterior surface of the pipe;

5 a substantially annular rotor rotationally disposed within the stator and having a common central axis with the pipe, the rotor having at least one internal gallery extending substantially around the radius of the pipe;

at least one coating head having an internal passage for the coating material and an opening in close contact with the exterior surface of the
10 pipe, the internal passage connected to the at least one internal gallery;

drive means for rotating the rotor and the at least one coating head around the exterior of the pipe;

means for supplying the coating material from an external source to the at least one internal gallery; and

15 means for applying positive air pressure to the at least one internal gallery, whereby the coating material is forced by air pressure through the at least one internal gallery and ejected onto the exterior surface of the pipe through the at least one coating head.

20 2. The apparatus of Claim 1 wherein the means for supplying the coating material and the means for applying positive air pressure further comprises at least one vacuum displacement pump attached to the stator, each of the at least one vacuum displacement pumps having a first port for connection to an external source of coating material and a second port for
25 connection to an external source of compressed air.

3. The apparatus of Claim 2 wherein the at least one vacuum displacement pump further comprises an outlet opening into the at least one internal gallery.

4. The apparatus of Claim 3 wherein sealing means are provided between the at least one internal gallery and the outlet to prevent release of the coating material from the at least one internal gallery.

5

5. The apparatus of any preceding claim further comprising at least one air port in the stator, the air port connected to a pressurized air source whereby a positive air pressure is maintained on the sealing means.

10

6. The apparatus of any preceding claim wherein the at least one coating head has a diffusing means within the internal passage of the at least one coating head.

15

7. The apparatus of any preceding claim further comprising means for supplying a grit from an external source to the at least one internal gallery and means for applying positive air pressure to the at least one internal gallery, whereby the grit is forced by air pressure through the at least one internal gallery and ejected onto the exterior surface of the pipe through the at least one coating head.

20

8. The apparatus of any preceding claim further comprising means for supplying a gas from an external source to the at least one internal gallery and means for applying positive air pressure to the at least one internal gallery, whereby the heated gas is forced by air pressure through the at least one internal gallery and ejected onto the exterior surface of the pipe through the at least one coating head.

25

9. The apparatus of any preceding claim further comprising means for supplying a quench fluid from an external source to the at least one internal

gallery and means for applying positive air pressure to the at least one internal gallery, whereby the quench fluid is forced by air pressure through the at least one internal gallery and ejected onto the exterior surface of the pipe through the at least one coating head.

5

10. The apparatus of any preceding claim wherein the stator and the rotor include means for opening and closing around the pipe.

11. The apparatus of any preceding claim further comprising at least one magnetic induction heater to heat the pipe prior to placement of the coating material onto the exterior surface of the pipe.

12. A method of applying a coating material to the exterior surface of a pipe comprising the following steps:

15 supplying at a positive air pressure the coating material to a stationary element surrounding the pipe;

transferring the coating material from the stationary element to a gallery within a rotating element disposed substantially within the stationary element, the gallery substantially surrounding the pipe; and

20 ejecting the coating material onto the exterior surface of the pipe from a one or more coating heads having an internal passage connected to the gallery.

13. The method of Claim 12 further comprising the following steps:

25 supplying at a positive air pressure a grit to the stationary element; transferring the grit from the stationary element to the gallery; and ejecting the grit onto the exterior surface of the pipe from one or more coating heads.

14. The method of Claims 12 or 13 further comprising the following steps:

supplying at a positive air pressure a gas to the stationary element;
transferring the gas from the stationary element to the gallery; and
5 ejecting the gas onto the exterior surface of the pipe from one or more coating heads.

15. The method of any one of Claims 12 to 14 further comprising the following steps:

10 supplying at a positive air pressure a quench liquid to the stationary element;
transferring the quench liquid from the stationary element to the gallery;
and
ejecting the quench liquid onto the exterior surface of the pipe from one
15 or more coating heads.

16. An apparatus for application of a coating material to the exterior surface of a pipe comprising:

a substantially annular-shaped body disposed around the exterior of
20 the pipe;

at least one entry port peripherally disposed around the body, the entry port connected to a first end of an intake chamber disposed within the body;

a compression chamber disposed within the annular-shaped body
25 and extending substantially around the radius of the pipe, a first end of the chamber connected to a second end of the intake chamber;

at least one diffusing chamber disposed within the annular-shaped body and extending substantially around the radius of the pipe, a first end of each the at least one diffusing chambers connected to a second end of the

compression chamber;

a gallery disposed within the inner circumferential side of the annular-shaped body, a second end of each the at least one diffusing chambers opening into the gallery;

5 an interchangeable sleeve disposed against the inner circumferential side of the annular-shaped body, the interchangeable sleeve having one or more openings to the gallery;

means for supplying the coating material from an external source to each of the at least one entry ports; and

10 means for applying positive air pressure to each of the at least one entry ports, whereby the coating material is forced under air pressure successively through the intake, compression and diffusing chambers, into the gallery and ejected through the one or more openings in the interchangeable sleeve onto the exterior surface of the pipe around the
15 entire circumference of the pipe.

17. The apparatus of Claim 16 wherein the means for supplying the coating material and the means for applying positive air pressure further comprises a mixing chamber attached to the entry port, the mixing chamber
20 having a fitting connected to the external source of the coating material and a port to an external source of compressed air.

18. The apparatus of Claims 16 or 17 wherein the annular-shaped body includes means for opening and closing around the pipe.

25

19. The apparatus of any one of Claims 16 to 18 further comprising means for supplying a grit from an external source to the at least one entry ports and means for applying positive air pressure to the at least one entry ports, whereby the grit is forced under air pressure successively through the

intake, compression and diffusing chambers, into the gallery and ejected through the one or more openings in the interchangeable sleeve onto the exterior surface of the pipe around the entire circumference of the pipe.

5 20. The apparatus of any one of Claims **16** to **19** further comprising means for supplying a gas from an external source to the at least one entry ports and means for applying positive air pressure to the at least one entry ports, whereby the gas is forced under air pressure successively through the intake, compression and diffusing chambers, into the gallery and ejected
10 through the one or more openings in the interchangeable sleeve onto the exterior surface of the pipe around the entire circumference of the pipe.

21. The apparatus of any one of Claims **16** to **20** further comprising means for supplying a quench liquid from an external source to the at least
15 one entry ports and means for applying positive air pressure to the at least one entry ports, whereby the quench liquid is forced under air pressure successively through the intake, compression and diffusing chambers, into the gallery and ejected through the one or more openings in the interchangeable sleeve onto the exterior surface of the pipe around the
20 entire circumference of the pipe.

22. The apparatus of any one of Claims **16** to **21** further comprising at least one magnetic induction heater to heat the pipe prior to placement of the coating material on to the exterior surface of the pipe.

25

23. A method of applying a coating material to the exterior surface of a pipe comprising the following steps:

supplying at a positive air pressure the coating material to an at least one intake chamber within a substantially annular-shaped body

surrounding the pipe;

compressing the coating material received from the at least one intake chamber in a compression chamber substantially surrounding the exterior of the pipe within the body;

5 diffusing the coating material exiting the compression chamber in an at least one diffusing chamber substantially surrounding the exterior of the pipe within the body; and

ejecting the coating material from the at least one diffusing chamber onto the exterior surface of the pipe.

10

24. The method of Claim **23** further comprising the following steps:

supplying at a positive air pressure a grit to the at least one intake chamber;

15 compressing the grit received from the at least one intake chamber in the compression chamber;

diffusing the grit exiting the compression chamber in the at least one diffusing chamber;

injecting the grit exiting the compression chamber into the gallery; and

20 ejecting the grit from the at least one diffusing chamber onto the exterior surface of the pipe.

25. The method of Claims **23** or **24** further comprising the following steps:

25 supplying at a positive air pressure a gas to the at least one intake chamber;

compressing the gas received from the at least one intake chamber in the compression chamber;

diffusing the gas exiting the compression chamber in the at least one diffusing chamber;

injecting the gas exiting the compression chamber into the gallery; and
ejecting the gas from the compression chamber onto the exterior surface
of the pipe.

- 5 26. The method of any one of Claims **23** to **25** further comprising the
following steps:
- supplying at a positive air pressure a quench liquid to the at least one
intake chamber;
- compressing the quench liquid received from the at least one intake
10 chamber in the compression chamber;
- diffusing the quench liquid exiting the compression chamber in the at
least one diffusing chamber;
- injecting the quench liquid exiting the compression chamber into the
gallery; and
- 15 ejecting the quench liquid from the compression chamber onto the
exterior surface of the pipe.

1 / 3

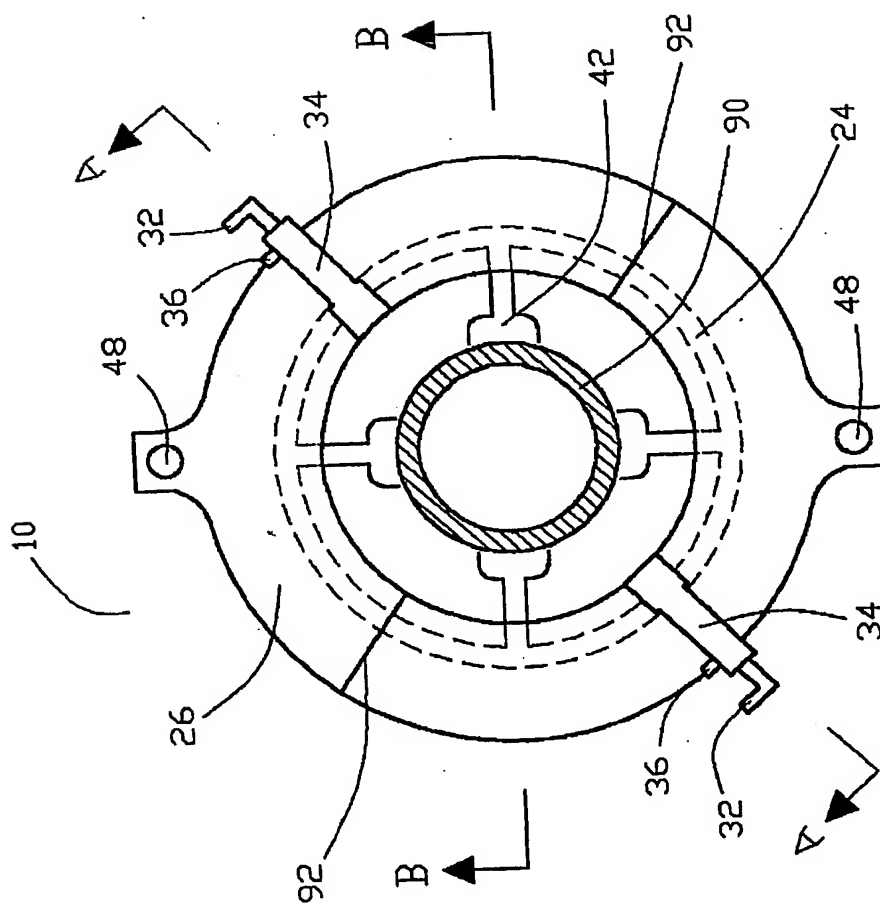
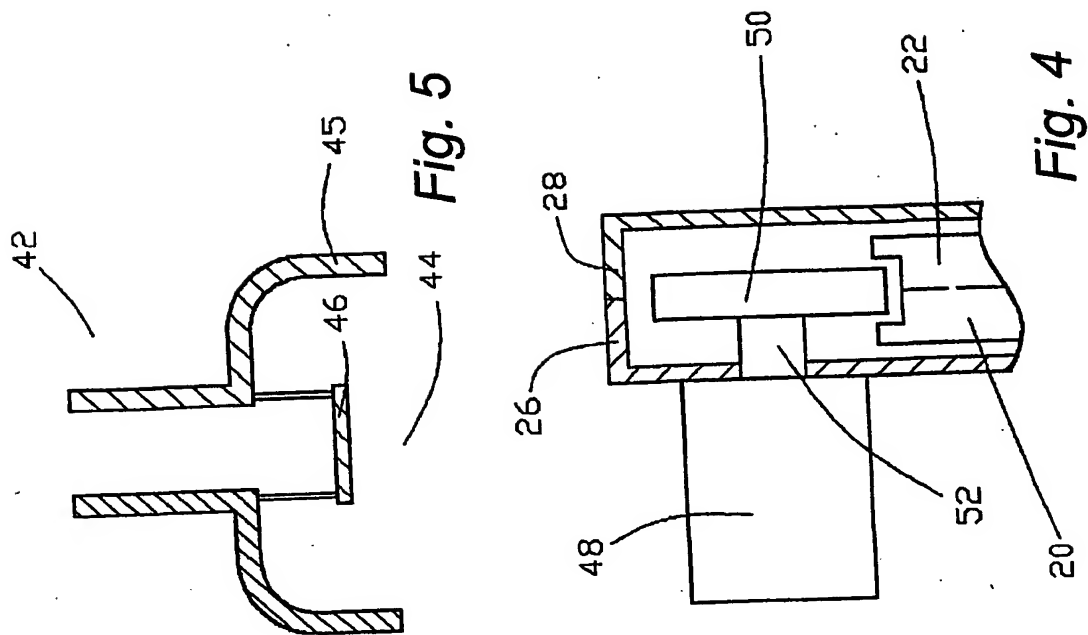


Fig. 1

2 / 3

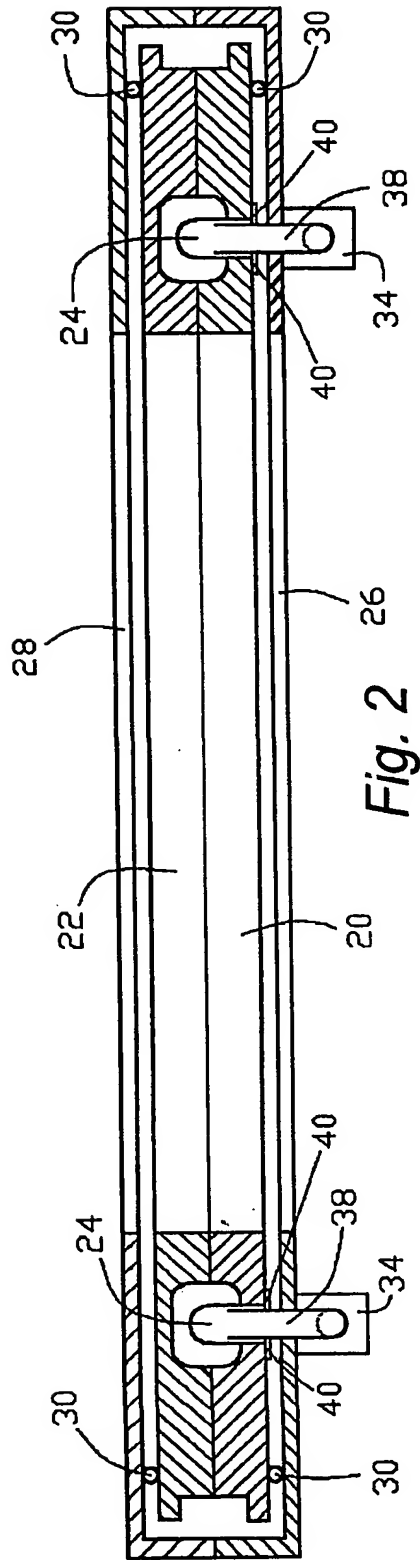


Fig. 2

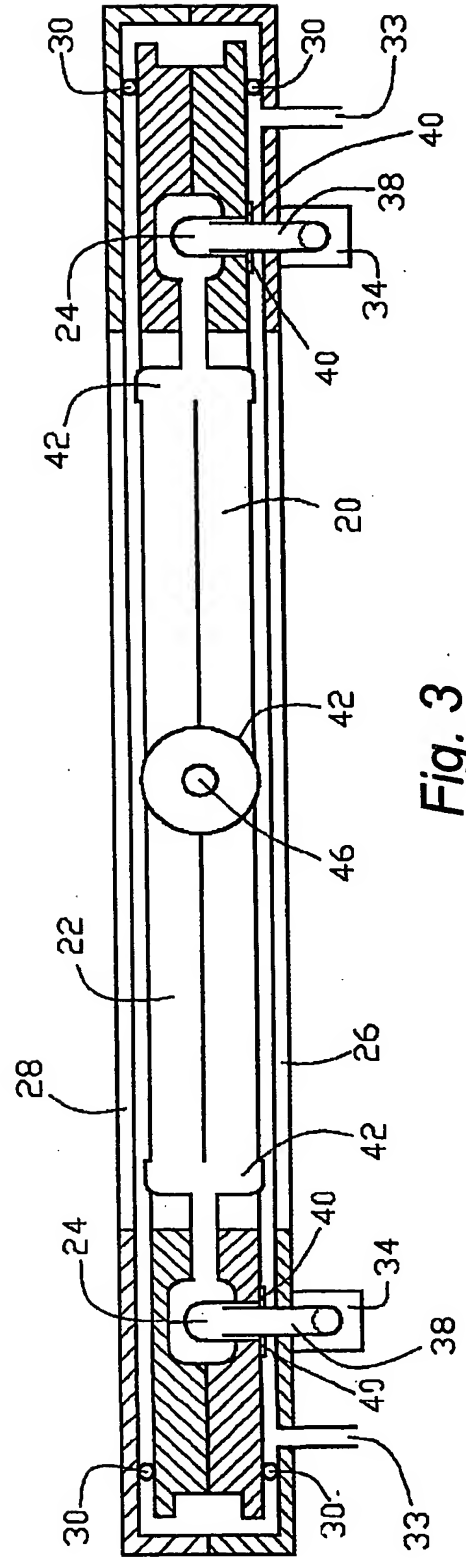


Fig. 3

3 / 3

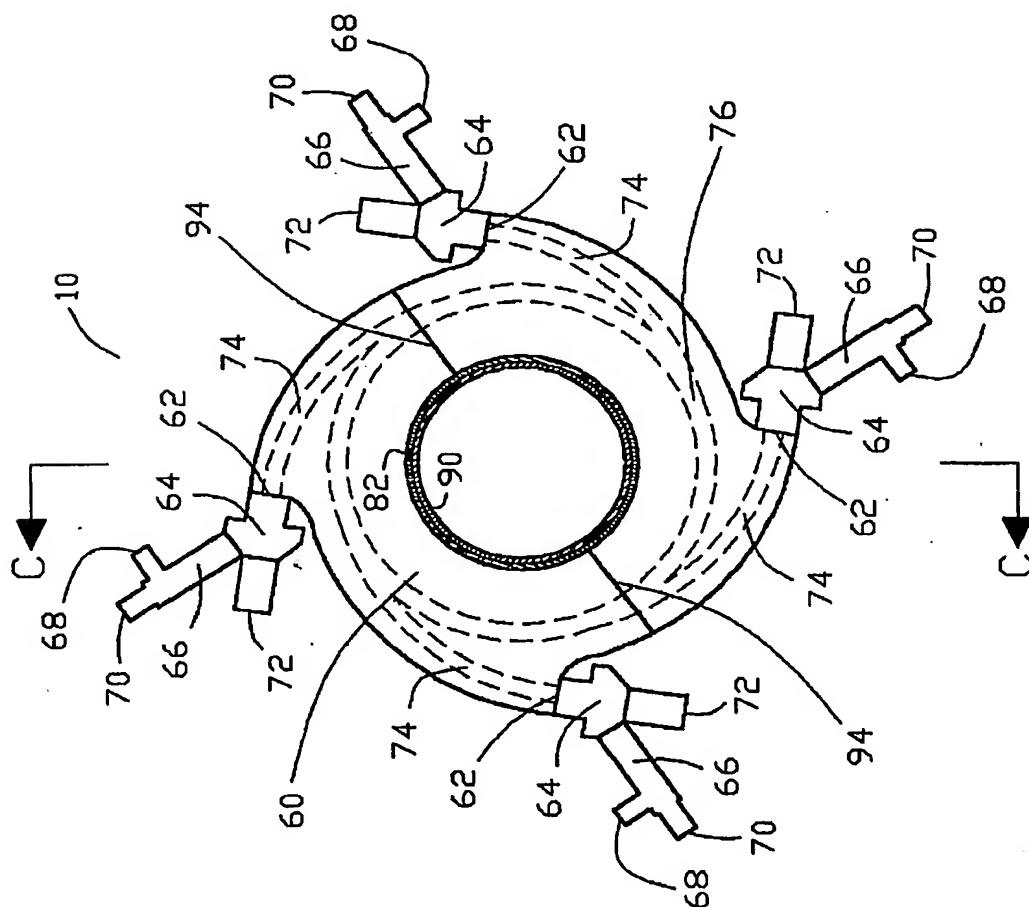


Fig. 6

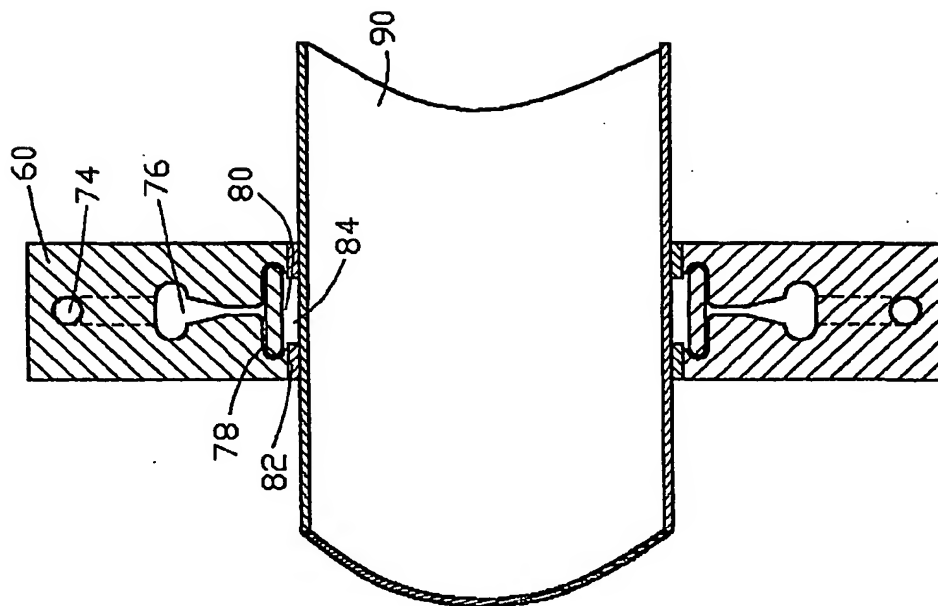


Fig. 7

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are stated below next to my name:

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Apparatus And Method For Coating The Exterior Surface of A Pipe

the specification of which is attached hereto unless the following box is checked

☒ was filed on May 17, 2001 as Application No. _____ or PCT Application No. PCT/GB01/02189 and amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S)

COUNTRY/OFFICE	APPLICATION NO.	DATE OF FILING	PRIORITY CLAIMED
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>
			<input type="checkbox"/> YES NO <input type="checkbox"/>

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

PROVISIONAL APPLICATION NUMBER
60/206,093

DATE OF FILING
May 20, 2000

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or §365(c) of any PCT International application(s) designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose material information as defined in 37 CFR §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

**PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS
DESIGNATING THE U.S. FOR BENEFIT UNDER 25 U.S.C. §120**

Status (check one)

Application Serial No.	Date of Filing	Patented	Pending	Abandoned
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

And I hereby appoint Arthur H. Seidel, Registration No. 15,979; Gregory J. Lavorgna, Registration No. 30,469; Daniel A. Monaco, Registration No. 30,480; Thomas J. Durling, Registration No. 31,349; John J. Marshall, Registration No. 29,671; Joseph R. Delmaster, Jr., Registration No. 38,399 and Robert E. Cannuscio, Registration No. 36,469, my attorneys or agents with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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